Statistical Forecasting of Ionospheric Weather

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A long-term goal of the National Space Weather Program is to produce forecasts of the space weather environment that are accurate and reliable. An important step toward this goal will be to develop a *statistical* system for forecasting *ionospheric* weather. We report initial progress on the development of a short-term (1 - 4 hour), statistical system to forecast ionospheric weather on both global and regional scales, based upon data supplied by the Global Positioning System (GPS). GPS measurements of total electron content provide the only *global* and *instantaneous* data set describing the *near-earth* environment. Our forecasting system will rely upon time series analysis of global ionospheric maps of total electron content, created in near real-time using methodology developed previously at JPL. Forecasts are constructed from time projections of the coefficients of the basis functions used to represent these maps. Rather than project the coefficients directly, however, an autoregression model is used to project the *wavelet transform* of these coefficients. The purpose of the wavelet transform is to perform spatial decorrelation of the original coefficients. An inverse wavelet transform then provides the values of the coefficients used to construct the forecast map. Among the many advantages of our forecasting system are the relative simplicity of the approach, the low cost of development, and the short lead time for implementation. Such a forecasting system offers the only prospect that can become operational prior to the advent of solar maximum in 2000.